Geophysical Research Abstracts, Vol. 9, 02808, 2007
SRef-ID: 1607-7962/gra/EGU2007-A-02808

Can cover crops reduce the hydrological connectivity in rainfed orchards with limited water availability?

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Land degradation forms a severe problem in the extensive olive and almond plantations in Southeast Spain. Under rainfed conditions, the canopy cover of these systems is typically below 30%: the soil is frequently tilled to avoid competition for water between the tree crop and weeds and to increase the infiltration capacity. This paper aims to 1) investigate if the water balance of the current almond cropping system allows the growth of cover crops; 2) investigate the frequency, pattern and importance of concentrated flow at the field (2 ha) and catchment scale (4.6 km^2) in a case study from Murcia province. Previous studies have shown that evaporation from the plough layer forms the largest water loss of rainfed orchards. In theory, this water can be used to grow a cover crop without competition for water with the trees. Hence, the amount of water available for cover crops was estimated by simulation of the evaporation from the upper 15 cm of the soil with the BUDGET water balance model. First, the model was calibrated for a silt loam soil on marl and a sandy loam soil on slates/phyllites with an average stone content of 47%. Subsequently, the model was run for a normal, wet and dry year, in order to represent the high interannual rainfall variability. The preliminary results show an evaporation loss from the upper 15 cm of the soil of 137-156 mm during the October-March winter period of the 'normal' year. The evapotranspiration of a shallow rooting cover crop would use a similar amount of water and therefore would not have a negative impact on the growth of the tree crop. At the field scale, the effect of runoff events on the water balance appears to be limited. On average there are 1-3 events a year producing an annual runoff loss of 3-13 mm. Re-infiltration of runoff in the field only affects about 5% of the surface. However, in one field a runoff

event of just 2 mm produces an extra water supply of up to 54 mm for the trees on the terrace where the runoff re-infiltrates. Depending on the local climate and agricultural land use, it may be unfeasible to grow cover crops on the entire field. In that case, it is an option to limit vegetation measures to the locations that are most crucial for the hydrological connectivity between fields and land units. Field surveys of concentrated flow were carried out after rain events of different size in order to identify such locations on agricultural land. The results show that roads, terrace access tracks and terraces which are either badly maintained or poorly designed are most crucial for the generation of concentrated flow.